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**CERTIFIED MAIL  
RETURN RECEIPT REQUESTED**

September 24, 1997

Mr. Michael J. Zamorski  
Acting Area Manager  
Kirtland Area Office  
US Department of Energy  
P.O. Box 5400  
Albuquerque, New Mexico 87185-5400

RE: Request for Supplemental Information: Background Concentrations Report, SNL/ KAFB

Dear Mr. Zamorski:

The New Mexico Environment Department's (NMED) Hazardous and Radioactive Materials Bureau has completed review of the March 1996 report, **Background Concentrations of Constituents of Concern to the Sandia National Laboratories/New Mexico and the Kirtland Air Force Base Installation Restoration Program**, and requires Supplemental Information. General and specific comments are enclosed. NMED's (NMED) Department of Energy Oversight Bureau (DOE OB) and the US Environmental Protection Agency also provided technical comments which were considered in the staff review.

A response to this request must be received within 60 days of receipt of this letter.

Two additional important points relating to background concentrations at Sandia National Laboratories/New Mexico (SNL) are discussed below.

- I. **Approved background concentrations.** As a result of the review of the background concentrations report, there were many constituents of concern for which NMED recommended a lower background value than did SNL. Since the background concentrations report was submitted, NMED and SNL have reached consensus on most, but not all, values over which there was disagreement.

Because of the importance of approved background concentrations to the furtherance of the Environmental Restoration Program at SNL, NMED is formally approving the concentrations on which consensus was reached. The approved background concentrations are contained in five tables, which are enclosed for your information and use.

Mr. Michael J. Zamorski  
September 24, 1997  
Page 2

**II. New background values for metals in soils.** In addition, it is NMED's understanding that:

SNL will withdraw Appendix C from their Background Study report;

SNL will determine new background values for metals in soils, focusing on the Canyons area;

The new background values for metals will be based on a new data set, consisting of selected SNL and DOE OB results as well as new SNL soil analyses for the area; and

Background values for soils, to replace those originally reported in Appendix C of the Background Study report, will be submitted to the Hazardous and Radioactive Materials Bureau.

The new background values for metals in soils should be submitted within 60 days of receipt of this letter.

Please contact Stephanie Kruse of my staff at 827-1561 if you have any questions or comments.

Sincerely,



Robert S. (Stu) Dinwiddie, Ph. D., Manager  
RCRA Permits Management Program

Enclosures

xc: John Parker, NMED/DOE OB  
Roger Kennett, NMED/DOE OB  
Mark Jackson, DOE/KAO  
Warren Cox, SNL  
David Neleigh, EPA

New Mexico Environment Department Hazardous and Radioactive Materials Bureau

Approved Background Concentrations,  
Sandia National Laboratories/Kirtland Air Force Base

Table 1  
Chemical Constituents in Soil

COC (Depth) Area Group <sup>(1)</sup>	SNL Median  (mg/kg)	SNL 95th Percentile or UTL  (mg/kg)	HRMB Median  (mg/kg)	HRMB Maximum Sample Value (mg/kg)	HRMB Maximum Background  (mg/kg)
Sb (surface and subsurface) N/T/SW/CTF/Off	<6	3.9	NA <sup>(2)</sup>	NA	3.9
As (surface) N/SW/CTF/Off (subsurface) N/T/SW/Off CTF	2.5  2 2.7	5.6  4.4 7	2.5	8.4	5.6  4.4 7
Ba (surface) N/Off T SW/CTF (Subsurface) SW/CTF N/T/Off	100 156 59  71.7 101	200 534 130  214 336	90.5	200	200 281 130  214 200
Be (surface and subsurface) N/T SW/CTF/Off	0.43 0.34	0.80 0.65	<1	<1	0.80 0.65
Cd (surface) N/SW/CTF/Off T (subsurface) N/T/SW/CTF/Off	<0.5 1.0  <0.5	1.6 5.1  0.9	<1	<1	<1 <1  0.9

Table 1  
Chemical Constituents in Soil (con'd.)

COC (Depth) Area Group <sup>(1)</sup>	SNL Median (mg/kg)	SNL 95th Percentile or UTL (mg/kg)	HRMB Median (mg/kg)	HRMB Maximum Sample Value (mg/kg)	HRMB Maximum Background (mg/kg)
Total Cr (surface) N/SW/CTF/Off T SW (subsurface) T SW	6.3 12.35  5.7 9.10 6.4	17.3 21.8  12.8 16.2 15.9	8.0	20.0	17.3 21.8  12.8 16.2 15.9
Cr <sup>+6</sup> (surface and subsurface) SW	<0.1	<2.5	NA	NA	1
Co (surface) N/Off T SW/CTF (subsurface) N/Off T SW/CTF	4.4 5.8 2.95  4.8 6.6 3.0	7.1 11.6 5.2  8.8 10.7 5.2	5.0	9.3	7.1 9.3 5.2  8.8 9.3 5.2
Cu (surface) N T SW/CTF/Off (subsurface) N T SW/CTF/Off	10.1 16.7 5.9  14.7 27.35 6.3	25.5 27.7 15.4  88.2 224 18.2	10.0	17	17 17 15.4  17 17 18.2
Pb (surface) N/T SW/CTF/Off (subsurface) N/T SW/Off	13.0 7.8  5.0 4.9	68 21.4  11.2 11.8	11	39	39 21.4  11.2 11.8

Table 1  
Chemical Constituents in Soil (con'd.)

COC (Depth) Area Group <sup>(1)</sup>	SNL Median  (mg/kg)	SNL 95th Percentile or UTL  (mg/kg)	HRMB Median  (mg/kg)	HRMB Maximum Sample Value (mg/kg)	HRMB Maximum Background  (mg/kg)
<b>Hg</b> (surface) N/T/SW/CTF/Off	<0.1	0.31	<0.25	<0.25	<0.25
(subsurface) N/T/SW/CTF/Off	<0.1	<0.1			<0.1
<b>Ni</b> (surface and subsurface) N/Off T SW/CTF	7.0 11.5 6.0	25.4 52.5 11.5	8.0	21.0	25.4 21.0 11.5
<b>Se</b> (Surface and subsurface) N/T/SW/CTF/Off	<1	<1	NA	NA	<1
<b>Ag</b> (surface) N/SW/CTF/Off (subsurface) N/T/SW/CTF/Off	<1  <1	2.0  <1	<1	<1	<1  <1
<b>Tl</b> (surface and subsurface) N/T/SW/CTF/Off	<0.5	<1.1	<1	2	<1.1
<b>Sn</b> (surface and subsurface) N/T/CTF/Off	<51.5	<122	<10	<10	<10
<b>Total U</b> (surface) N/T/SW/CTF/Off (subsurface) N/SW	2.2  1.25	3.42  2.3	NA	NA	3.42  2.3
<b>V</b> (surface) N/T SW/CTF/Off (subsurface) N/T SW/Off	25.0 12.1  23.75 13.8	47.2 20.4  42.8 21.5	23.0	33.0	33.0 20.4  33.0 21.5

Table 1  
Chemical Constituents in Soil (con'd.)

COC (Depth) Area Group <sup>(1)</sup>	SNL Median  (mg/kg)	SNL 95th Percentile or UTL  (mg/kg)	HRMB Median  (mg/kg)	HRMB Maximum Sample Value (mg/kg)	HRMB Maximum Background  (mg/kg)
<b>Zn</b> (surface and subsurface)					
N	33.7	82.4	32.0	76	76
T	44.8	117			76
SW/CTF/Off	22.75	62			62
<b>Zr</b> (surface and subsurface)					
Off	5.35	9.2	NA	NA	9.2

Notes:

(1) Area Groups: N = North, T = Tijeras, SW = Southwest, CTF = Coyote Test Field, Off = Off-site

(2) NA = not analyzed

New Mexico Environment Department/Hazardous and Radioactive Materials Bureau

Approved Background Concentrations  
Sandia National Laboratories/Kirtland Air Force Base

Table 2  
Radiological Constituents in Soil

COC (depth) Area Group <sup>(1)</sup>	SNL Median  (pCi/g)	SNL 95th Percentile or UTL  (pCi/g)	HRMB Median  (pCi/g)	HRMB Maximum Sample Value (pCi/g)	HRMB Maximum Background  (pCi/g)
Cs-137 (surface) N/Off T SW/CTF (subsurface) N/Off SW	0.239 0.380 0.1475 0.000 0.000	0.836 0.908 0.664 0.084 0.0789	0.411	3.545	0.836 0.908 0.664 0.084 0.079
Ra-226 (surface) N/SW (subsurface) N/SW T	0.985 0.870 0.500	2.30 1.76 0.90	1.992	3.827	2.30 1.76 0.90
Ra-228 (surface) N SW (subsurface) N T SW	0.872 0.716 0.900 0.400 0.620	1.33 1.01 1.20 0.70 0.93	NA <sup>(2)</sup>	NA	1.33 1.01 1.20 0.70 0.93
Sr-90 (surface) N/T/SW/Off	0.29	1.98	NA	NA	1.08
Th-232 (surface and subsurface) N SW/Off	0.970 0.718	1.54 1.01	0.980	1.540	1.54 1.01

Table 2  
Radiological Constituents in Soil (con'd.)

COC (depth) Area Group <sup>(1)</sup>	SNL Median  (pCi/g)	SNL 95th Percentile or UTL  (pCi/g)	HRMB Median  (pCi/g)	HRMB Maximum Sample Value (pCi/g)	HRMB Maximum Background  (pCi/g)
<b>Th-234</b> (surface and subsurface) N/SW	<1.48	1.4	NA	NA	1.4
<b>U-234</b> (surface and subsurface) N SW	1.0 <4.72	1.6 <5.02	0.78	1.29	1.6 1.6
<b>U-235</b> (surface and subsurface) N/CTF SW	0.0555 0.0448	0.18 0.16	0.06	0.12	0.18 0.16
<b>U-238</b> (surface and subsurface) N/Off SW	0.835 <0.492	1.3 1.4	0.850	1.400	1.3 1.4

Notes:

(1) Area Groups: N = North, T = Tijeras, SW = Southwest, CTF = Coyote Test Field, Off = Off-site

(2) NA = not analyzed



New Mexico Environment Department/Hazardous and Radioactive Materials Bureau

Approved Background Concentrations  
Sandia National Laboratories/Kirtland Air Force Base

Table 3  
Chemical Constituents in Ground Water

COC	EPA PQL <sup>(1)</sup>  (µg/L)	EPA Analytical Method	NMED Contract Lab Detection Limit <sup>(2)</sup> (µg/L)	EPA MCL <sup>(3)</sup>  (µg/L)	HRMB 95th % or UTL  (µg/L)	SNL 95th % or UTL  (µg/L)	HRMB Maximum Background  (µg/L)
Sb	300 30	6010 7041	50	6	NA <sup>(6)</sup>	<50	6
As	500 10	6010 7060	10	50	NA	14	14
Ba	20	6010	100	2000	200	120	120
Be	3	6010	4	4	NA	<5	4
Cd	40 1	6010 7131	0.5	5	<1	0.47	0.47
Cr total	70 10	6010 7191	1	100	31	71	43
Cr <sup>+6</sup>	70 10	6010 7191	1	100	NA	<10	<10
Co	70	6010	10	50 <sup>(5)</sup>	<10	2.5	2.5
Cu	60	6010	10	1000 <sup>(5)</sup>	<50	<50	<50
Pb	40 10	6010 7421	2	15	13	10	10
Hg	2	7470	0.2	2	NA	<5	2
Ni	50	6010	20	100	28	<60 200	28 28
Se	750 20	6010 7740	5	50	NA	5	5
Ag	70	6010	10	50	NA	<40	<10
Tl	400 10	6010 7841	5	2	NA	<4000	2
Sn	8000	7870 6010	30	---	NA	<500	50

Table 3  
Chemical Constituents in Ground Water (con'd.)

COC	EPA PQL <sup>(1)</sup>  (µg/L)	EPA Analytical Method	NMED Contract Lab Detection Limit <sup>(2)</sup> (µg/L)	EPA MCL <sup>(3)</sup>  (µg/L)	HRMB 95th % or UTL  (µg/L)	SNL 95th % or UTL  (µg/L)	HRMB Maximum Background  (µg/L)
U total	----	----	5 <sup>(4)</sup>	20 <sup>(6)</sup>	NA	5.2	5.2
V	80 40	6010 7911	10	20 <sup>(7)</sup>	13	13 4.1	13 4.1
Zn	20	6010	20	5000	2230	260 470	260 470
Zr	----	----	----	----	NA	NA	----
NO3/ NO2	----	353.2	0.1	10000	---- <sup>(9)</sup>	6000	4000

Notes:

- (1) Environmental Protection Agency (EPA) Practical Quantitation Limit (PQL), 40CFR 264 Appendix IX
- (2) Typical detection limit achieved by NMED contract laboratory (American Environmental Network, unless specified otherwise)
- (3) EPA Maximum Contaminant Limit
- (4) New Mexico Department of Health Scientific Laboratory Division (SLD) detection limit
- (5) New Mexico Water Quality Control Commission standard
- (6) Proposed EPA Maximum Contaminant Limit
- (7) EPA Lifetime Health Advisory
- (8) NA = not analyzed
- (9) NO3/NO2 could not be reliably established for the KAFB area on a site-wide basis (Moats and Winn, 1995)

New Mexico Environment Department/Hazardous and Radioactive Materials Bureau

Approved Background Concentrations  
Sandia National Laboratories/Kirtland Air Force Base

Table 4  
Radiological Constituents in Ground Water

COC	EPA Maximum Contaminant Limit (pCi/L)	SLD Detection Limit <sup>(1)</sup> (pCi/L)	HRMB 95th % or UTL (pCi/L)	SNL 95th % or UTL (pCi/L)	HRMB Maximum Background (pCi/L)
Cs-137	----	40	NA <sup>(5)</sup>	9.3	9.3
Ra-226	5 <sup>(2)</sup>	0.2	NA	2.7	2.7
Ra-228	5 <sup>(2)</sup>	2	NA	4.7	4.7
Rn-222	300 <sup>(3)</sup>	20	NA	NA	300
Sr-90	----	----	NA	<1.6	<1.6
Th-232	----	0.1	NA	0.17	0.17
Th-234	----	104 <sup>(4)</sup>	NA	NA	<104
U-234	----	0.1	NA	7 18	7 18
U-235	----	0.1	NA	0.41 0.76	0.41 0.76
U-238	----	0.1	NA	3.0 7.4	3.0 7.4

Notes:

- (1) SLD = New Mexico Health Department Scientific Laboratory Division
- (2) Maximum Contaminant Limit actually applies to Radium 226 + Radium 228
- (3) Proposed EPA Maximum Contaminant Limit
- (4) NMED contract laboratory (American Environmental Network) detection limit
- (5) NA = not analyzed

New Mexico Environment Department/Hazardous and Radioactive Materials Bureau

Approved Background Concentrations  
Sandia National Laboratories/Kirtland Air Force Base

Table 6  
Canyons Study -- Radiological Constituents in Soil

COC Area Group <sup>(1)</sup>	SNL Median  (pCi/g)	SNL 95th Percentile or UTL  (pCi/g)	HRMB Median  (pCi/g)	HRMB Maximum Sample Value (pCi/g)	HRMB Maximum Background  (pCi/g)
Cs-137 LC UC CB Fan	0.256 0.036 0.441 0.147	1.55 0.515 1.063 0.664	0.411	3.545	1.55 0.515 1.063 0.664
Ra-226 UC LC/UC/Fan	1.60 1.00	2.66 2.60	1.992	3.827	2.66 2.60
Ra-228 LC/UC/Fan	0.714	1.080	NA <sup>(2)</sup>	NA	1.080
Sr-90 LC/UC/CB Fan	NA 0.29	NA 1.98	NA	NA	1.08 1.08
Th-232 LC/UC/Fan	0.72	1.03	0.98	1.54	1.03
Th-234 LC/UC/Fan CB	<1.48 1.31	3.4 2.31	NA	NA	2.31 2.31
U-234 LC/UC/Fan	<18.1	<21.4	0.780	1.290	2.31
U-235 LC/UC/CB/Fan	<0.048	<0.391	0.06	0.12	0.16

Table 6  
Canyons Study - Radiological Constituents in Soil (con'd.)

COC Area Group <sup>(1)</sup>	SNL Median  (pCi/g)	SNL 95th Percentile or UTL  (pCi/g)	HRMB Median  (pCi/g)	HRMB Maximum Sample Value (pCi/g)	HRMB Maximum Background  (pCi/g)
U-238 LC/UC/Fan	<1.74	2.31	0.850	1.400	2.31

Notes:

(1) Area Groups: LC = Lower Canyons, UC = Upper Canyons, CB = Canyons Background; see also note (1) of Table 1  
(2) NA = not analyzed

## COMMENTS

### BACKGROUND CONCENTRATIONS OF CONSTITUENTS OF CONCERN TO THE SANDIA NATIONAL LABORATORIES/NEW MEXICO ENVIRONMENTAL RESTORATION PROJECT AND THE KIRTLAND AIR FORCE BASE INSTALLATION RESTORATION PROGRAM MARCH 1966

#### General Comments

1.a. SNL should submit a map which clearly shows which Environmental Restoration sites are in which Area Groups. Also, a list of ER sites by area group would be helpful.

1.b. The data sets for some Constituents of Concern (COCs) contain abundant nondetects, which may be associated with five or more different detection limits (DLs). A table should be provided in the report which lists for each COC/medium all of the various detection limits and the percentage of the total data equal to or below each of the detection limits.

2. The written locations accompanying the soil data are not sufficient. A map should be generated for each COC/medium. The maps should only include the locations of those data actually used in the establishment of background conditions (rejected data should not be included). The locations and boundaries of SNL Environmental Restoration (ER) and KAFB IRP sites should also be shown on these maps.

Plate 1 (labeled by SNL as a draft) should only show the locations of those wells and springs actually used to establish background hydrochemistry. Ideally, a separate map should be generated for each COC to allow rapid evaluation of the extent of site-wide coverage.

#### Specific Comments on Section 4

3. Page 4-2, item 1

Cs-137 and Sr-90 are global fallout radionuclides which, at sites characterized by arid conditions (such as KAFB), should be mostly restricted to surface soils.

Any valid detections of Cs-137 and Sr-90 in soils at depth (i.e. subsurface soils) are considered to be indicators of contamination.

4. Page 4-3, item 10

Bullet 1 - Groundwater samples from Golf Course monitor wells were used in the analysis of background hydrochemistry for Sb, Cr<sup>+6</sup>, Cu, Hg, Ag, Tl, and Sn.

In addition to data from the KAFB Golf Course wells, data derived from groundwater samples collected at the KAFB sewage lagoon wells (KAFB-0501, KAFB-0502, KAFB-0503, KAFB-0503) are also suspect for many COCs and are possibly not representative of background conditions. Therefore, these data should not be used in the establishment of background hydrochemistry.

Bullet 2 - Clarification is needed. Were the data used or not used to establish background conditions for any COC?

Bullet 3 - SNL states, "The former production well KAFB-10...and monitor well CWL-BW3...are believed to have corroding well screens and/or stagnant water columns. Ground-water samples from these wells have high metals concentrations. Therefore, data from these wells were removed from the background data set of all COCs".

In contrast to what is stated above, analytical results of groundwater samples from CWL-BW3 were used by SNL to determine background hydrochemistry for Sb, Be, Cu, Hg, Ag, and Tl. Additionally, analytical results of groundwater samples from KAFB-10 were used to determine background hydrochemistry for Ra-226.

As with the data from well CWL-BW3, groundwater samples from CWL-BW2 also typically contain relatively high concentrations of chromium and nickel. CWL-BW2 is not normally completely purged by SNL prior to sampling. Therefore, SNL's concern about stagnant well water also applies to groundwater samples collected from well CWL-BW2. Thus, all data derived from groundwater samples obtained from CWL-BW2 should be rejected from the analysis of background hydrochemistry.

5. Page 4-4, item 11

What specifically are the 36 wells "bearing high nitrate plus nitrite"? What is meant by "high nitrate", and how was this defined prior to determining background conditions?

6. Page 4-4, item 12

Where did the groundwater samples come from that have detections of Cr<sup>+6</sup>?

Any valid detections of Cr<sup>+6</sup> are considered to be indicators of contamination.

7. Page 4-4, item 13

What is meant by "much larger than the bulk of the data" when referring to U-238/U-234 ratios? The U-234 activity for natural ground waters in New Mexico is typically about one to two times that of U-238 (Loren Berge, Scientific Laboratory Division, New Mexico Department of Health). Therefore, the U-238/U-234 ratio should generally be about 0.5 to 1.0 for natural ground waters.

Where did the samples come from that have "much larger" U-238/U-234 ratios?

8. Page 4-4, item 14

What is meant by "high barium" concentration values, and how was this defined prior to the determination of background conditions?

Were groundwater analyses for other metals also considered suspect, given the variety of industrial and hazardous wastes discharged at TA-2?

9. Page 4-4, item 15

As in the case of barium, turbid groundwater samples can exhibit relatively high concentrations of other metals. Groundwater samples that are highly turbid should not be used in the determination of background hydrochemistry. Samples from CWL-MW2BU, CWL-MW5L, and CWL-MW6L have typically exhibited high turbidity.

10. Page 4-5, item 16

Where did the samples come from that have detections of Co-60 (the L. Dawson, 1994, reference in the text suggests somewhere at TA-5)?

Any valid detections of Co-60 are considered to be indicators of contamination.

11. Page 4-5, item 17

Where specifically at the CWL and Liquid Waste Disposal System (LWDS) did the soil samples come from that have detections of Cr<sup>+6</sup>?

Any valid detections of Cr<sup>+6</sup> are considered to be indicators of contamination.

12. Page 4-5, item 18

Clarification of the first paragraph of this item is requested.

Just because SNL collected samples from *proposed* No Further Action sites does not necessarily mean that such samples will be considered by the New Mexico Environment Department as representative of background conditions.

The purpose of the subject report was to establish background conditions in the KAFB area. Clarification is requested on how one compares analytical data of soil samples from the KAFB sewage lagoons, the CWL, and the LWDS to the "highest KAFB background value" or the "highest proposed KAFB no further action site" if background conditions at the time of the comparison were unknown?

Please explain why this screening method was limited to only the KAFB sewage lagoons, the CWL, and the LWDS. Why not also apply it to data from all of the other SNL ER and KAFB IRP sites? This issue reinforces the concern about too much data being associated with contaminated or potentially contaminated sites.

13. Page 4-5, item 19

What is meant by "high concentration values for barium" in TA-2 soils and how was this defined prior to the determination of background conditions?



14. Page 4-6, item 20

What is meant by "much larger than unity" when referring to U-238/U-234 ratios? For natural soils, the activity of U-234 is typically about equal to that of U-238 (Loren Berge, Scientific Laboratory Division, New Mexico Department of Health). Therefore, the U-238/U-234 ratio should generally be about 1.0 for natural soils.

Where did the samples come from that have "much greater than unity" U-238/U-234 ratios?

15. Page 4-6, item 2

"The value(s) for the specific COC for which the sample was believed to be contaminated were **initially** eliminated..."(emphasis added).

This statement needs clarification.

16. Page 4-6, 2nd paragraph from bottom of page  
See comments No. 9 and No. 13.

This paragraph suggests that nitrate data from 36 wells were rejected because all 36 of the wells were contaminated as a result of stock grazing. Is this an accurate statement?

What are the seven wells which yield groundwater samples that are high in barium?

17. Page 4-6, last paragraph

This paragraph discusses a report entitled *Sample Condition Issues for ER Background Study*. The results for a few "representative COCs" should not be applied arbitrarily to other COCs. The other COCs have their own distinct sample population(s); this requires that they be analyzed individually.

SNL should explain, in detail, how the "representative COCs" were chosen.

In addition, the paragraph states (on page 4-7) "**Two distributions** were then established for each COC" (emphasis added). Is SNL referring to *two subsets of a sample population* for a given COC/medium?

18. Page 4-15, 2nd paragraph, last sentence, "Points that have the same concentration value will plot as a single point on the probability plot"

In the interim report (Anonymous, 1994), the probability plots were constructed using the ranked positions of data points, not their "standard normal deviate". Many of the COCs in this study are represented by hundreds (or thousands) of data points; however, similar numbers of data are not shown on the probability plots. Thus, it appears that many of the data representing a given COC are plotted as "single points." For many of the COCs investigated by this study, large percentages of data are of equal value because many of the data are less than a detection limit (DL). A plot of such data (at  $\frac{1}{2}$  DL) typically results in a curve which exhibits abrupt jumps in trend. In the many cases where there are a number of different detection limits for a given COC, the probability plots in SNL/KAFB's report become difficult to interpret.

As was done in the interim report (Anonymous, 1994), plotting ranked positions allows easy estimation of the concentration associated with any sample-population percentage. SNL should explain the advantages, if any, of plotting "standard normal deviates" on probability plots.

SNL should define "standard normal deviate".

19. Page 4-15, last paragraph

Histograms are useful in a statistical analysis of a data set. However, a number of histograms in the report contain nondetect data that are plotted at one-half their detection limit. This is considered to be an unacceptable practice because the actual concentration of the COC is known only to lie somewhere between the detection limit and zero. Arbitrarily plotting data on a histogram at one-half their detection limit(s) could result in problems inferring distributions and identifying the existence of multiple populations (including contaminated populations). Additionally, some of the box and whisker plots in the report are not valid because all of the data used to create them are nondetects. For examples of this issue, see plots for the Upper and Lower Canyons Super Groups for U-235 and U-238 in soils.

20. Page 4-18, 3rd paragraph, "Normal data sets"

SNL should explain why the  $T_n$  statistic was not calculated in all cases where the data of a COC were inferred to have a normal or log-normal distribution.

21. Page 4-21, Section 4.7, 3rd sentence, "Analyses from an ER or IRP site that were above the 95th UTL or 95th percentile *did not necessarily represent contamination.*"

Although it is true that 5% of the natural background population is expected to exceed the 95th UTL (or 95th percentile), so might the concentrations of contaminated samples. Any sample collected at an SNL ER or KAFB IRP site having a concentration exceeding the 95th UTL (or 95th percentile, where applicable) is considered to be representative of contamination, unless

A. the analytical results are shown to be in error, or

B. an acceptable site-specific background investigation is conducted and shows that background is naturally elevated above what was originally expected for the site.

On a case-by-case basis, samples considered by NMED to be representative of contamination may trigger a regulatory requirement for additional site characterization or site remediation.

**Specific Comments on Section 5**

22. Page 5-2, Section 5.1.1.2, Super Groups

SNL's decision to arbitrarily divide the KAFB area into five "Super Groups" prior to any significant analysis of the data sets should be explained more fully, including the rationale for specific boundaries.

23. Page 5-4, Off-site Super Group

Where exactly are the boundaries of the Off-site Super Group?

## Appendix C, Canyons Background Study, COCs in Soil

*If Sandia plans to withdraw Appendix C and submit new background values for metals in soils, comments on Appendix C (Comments 24 through 47) need not be addressed.*

24. Page C-1, 2nd paragraph

The referenced draft report has been finalized (Hostak, 1995).

25. Page C-3

What was the rationale for dividing the Canyons region into three spatial groupings (super groups)? The boundaries of the Upper Canyons (UC), Lower Canyons (LC), and Canyons Background (CB) Super Groups should be shown on a map.

All data from the UC and LC Super Groups appear to have come from ER Sites.

26. Page C-4, Sb in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data, the text, and Table C-2 suggests that all values were less than DLs of 0.20 or 0.21 mg/kg.

The analysis of background Sb may not be valid because of the high DL associated with the majority of the data.

27. Page C-5, As in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 1.6 to 7.1 mg/kg.

The analysis of background As for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

28. Page C-6, Ba in Soil

Figure C-7 suggests that data representing the UC/CB Area Group might be adequately approximated by a normal distribution.

29. Page C-8, Be in Soil

No DLs are listed for the data representing the CB Super Group. CB Super Group data range from 0.1 to 0.55 mg/kg.

The analysis of background Be for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

Figures C-10 and C-11 do not show adequately that data representing the CB Area Group can be approximated by a normal distribution.

30. Page C-9, Cd in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data, the text, and Table C-6 suggests that all values were less than DLs of 0.20 or 0.21 mg/kg.

Analysis of background Cd for the UC/LC/ CB Area Group may not be adequate because of the high DL associated with the majority of the data.

31. Page C-10, Total Cr in soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 7.5 to 14.2 mg/kg.

Analysis of background Cr for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

Figure C-13 does not adequately show that data representing the CB Area Group can be approximated by a log-normal distribution.

32. Page C-11, Co in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 4.3 to 8.9 mg/kg.

The analysis of background Co for the UC/LC Area Group may not be adequate because of the high DL associated with the majority of the data.

Figures C-16 and C-17 do not show adequately that data representing the CB Area Group can be approximated by a log-normal distribution.

33. Page C-13, Cu in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 6.1 to 17.5 mg/kg.

The analysis of background Cu for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

Figure C-19 does not show adequately that data representing the CB Area Group can be approximated by a log-normal distribution.

34. Page C-14, Pb in Soil

All data from ER Site 15 should be rejected from the analysis of background for Pb because of the site's proximity to mine workings of the South Frustration group. In addition, the 10 detections above 38.2 mg/kg are suspect because of historical site activities.

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 4.7 to 51.1 mg/kg.

The analysis of background Pb for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

Figures C-24 and C-25 do not show adequately that data representing the CB Area Group can be approximated by a log-normal distribution.

35. Page C-16, Hg in Soil

The six detections in the data set are suspect because of historical site activities.

Although no DLs are listed for the data representing the CB Super Group, inspection of the data, the text, and Table C-11 suggests that all values representing the CB Super Group were less than DLs of 0.1 or 0.11 mg/kg.

The analysis of background Hg for the UC/LC/CB Area Group may not be valid because of the high DL associated with the majority of the data.

36. Page C-17, Ni in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 7.1 to 16.3 mg/kg.

The analysis of background Ni for the UC/LC/CB Area Group is questionable because of the moderately high DL associated with the majority of the data.

37. Page C-18, Se in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 1.0 to 2.9 mg/kg.

The analysis of background Se for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

Figures C-30 and C-31 do not show adequately that data representing the CB Area Group can be approximated by a log-normal distribution.

38. Page C-20, Ag in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data, the text, and Table C-14 suggests that all values were less than DLs of 0.20 or 0.21 mg/kg.

The analysis of background Ag for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

39. Page C-21, Tl in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data, the text, and Table C-15 suggests that all but two values were less than DLs of 0.20 or 0.21 mg/kg. The maximum Tl value for the CB Super Group is 0.4 mg/kg.

The analysis of background Tl for the UC/LC Area Group may not be valid because of the high DL associated with the majority of the data.

40. Page C-23, V in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 16.1 to 38.9 mg/kg.

The analysis of background V for the UC/LC/CB Area Group is questionable because of the moderately high DL associated with the majority of the data.

41. Page C-24, Zn in Soil

Although no DLs are listed for the data representing the CB Super Group, inspection of the data suggests that all values were actual detections ranging from 28.7 to 43.9 mg/kg.

The analysis of background Zn for the UC/LC/CB Area Group is questionable because of the moderately high DL associated with the majority of the data.

42. Page C-26, Cs-137 in Soil

No DLs were reported for data representing the CB Super Group. Data representing the CB Super Group ranged from 0.007 to 0.876 pCi/g.

Figures C-44 and C-45 do not show adequately that data representing the CB Area Group can be approximated by a normal distribution. Furthermore, both the histogram and the probability plot suggest at least two populations may be present in the data set.

Page C-26, last paragraph - The text states that data representing the UC Super Group can be approximated by a log-normal distribution. However, Table C-18 shows that the distribution type is "nonparametric". Which is correct?

The box and whisker plot shown in Figure C-39 shows that, typically, Cs-137 activities are markedly higher in the LC Super Group compared to those in the UC Super Group. This is opposite of what might be expected (assuming that precipitation is higher in the UC Super Group compared to that of the LC Super Group).

43. Page C-28, Ra-226 in Soil

No DLs were reported for data representing the CB Super Group. Data representing the CB Super Group ranged from 0.16 to 1.91 pCi/g.

The box and whisker plots (Figure C-46) suggest that the data sets representing the UC and LC Super Groups are approximately the same. Was sufficient work done to show that these Super Groups should be separated for the purpose of establishing background Ra-226?

Figure C-50 suggests that at least two populations may be present in the data representing the UC Super Group.

44. Page C-31, Th-234 in Soil

No DLs were reported for data representing the CB Super Group. Data representing the CB Super Group ranged from 0.69 to 2.03 pCi/g.

45. Page C-33, U-234 in Soil

All of the data were reported as being less than their associated detection limits (DLs ranged from 13.8 to 21.4 pCi/g). The analysis of background U-234 for the UC/LC/Fan Area Group may not be valid because of the high DLs associated with the majority of the data from the UC and LC Super Groups.

The box and whisker plots (Figure C-62) for data representing the UC and LC Super Groups are invalid because all the data were listed as values below their associated DL (see also comments 21 and 22). Also, even if they were valid, the box and whisker plot for the Fan Super Group is not close to those of the UC and LC Super Groups. SNL should explain why the three Super Groups were combined into one Area Group.

Page C-34, 1st paragraph - The text says that the Fan Area Group is made up of 198 records. Figure C-62 indicates that the Fan Area Group has 14 records. Which is correct?

Figures C-63 and C-64 suggest that the data set may contain at least two populations. However, interpretations based on these figures are probably not reliable because of the plotting of nondetect data that are associated with excessively high DLs (see also comments 21 and 22).

46. Page C-34, U-235 in Soil

No DLs were reported for data representing the CB Super Group. Data representing the CB Super Group ranged from 0.01 to 0.19 pCi/g.

The analysis of background U-235 for the UC/LC/CB/Fan Area Group may not be valid because of the high DLs associated with the majority of the data from the UC and LC Super Groups.

The box and whisker plots (Figure C-65) for data representing the UC and LC Super Groups are invalid because all the data were listed as values below their associated DL (see also comments 21 and 22). Also, even if they were valid, the box and whisker plots for the CB and Fan Super Groups are not close to those of the UC and LC Super Groups. SNL should explain why the four Super Groups were combined into one Area Group.

Figure C-67 suggests that the data set may contain multiple populations. However, interpretations based on Figure C-67 are probably not reliable because of the plotting of nondetect data that are associated with high DLs (see also comments 21 and 22).

47. Page C-35, U-238 in Soil

All of the data were reported as being less than their associated detection limit (DLs ranged from 0.995 to 4.97 pCi/g). The analysis of background U-238 for the UC/LC/Fan Area Group may not be valid because of the high DLs associated with the majority of the data from the UC and LC Super Groups.

The box and whisker plots (Figure C-68) for data representing the UC and LC Super Groups are invalid because all the data were listed as values below their associated DL (see also comments 21 and 22). Also, even if they were valid, the box and whisker plot of the Fan Super Group is not close to those of the UC and LC Super Groups. SNL should explain why the three Super Groups were combined into one Area Group.

Figures C-69 and C-70 suggest that the data set may contain multiple populations. However, interpretations based on these figures are probably not reliable because of the plotting of nondetect data that are associated with high DLs (see also comments 21 and 22).

### **Specific Comments of Section 6**

48. Page 6-12, 2nd paragraph

Barium typically occurs in the natural environment as barium sulfate, a relatively insoluble compound. The source rocks of Tijeras Arroyo sediments are similar to those found in the lower and upper reaches of Arroyo del Coyote. The CTF and Southwest Super Groups also border Arroyo del Coyote, yet background barium concentrations for these areas are markedly lower than for the Tijeras Area Group.

If barium salts exist in Tijeras Arroyo, they are likely the result of contamination from explosives testing, such as was done at TA-2.

### **Editorial Comments**

49. Page 4-4, item 13

The first sentence contains what appears to be an error (radium-234 should be uranium-234).

50. Page 5-42, V in Soil

Table 5-19, last row - The sample group should be listed as the Southwest/CTF/Off-site Area Group.

### **Reference**

Hostak, J. M., 1995, Characterization of environmental radiation and radioactivity near Albuquerque, New Mexico: New Mexico Environment Department, Report NMED/DOE/AIP-95/3, 133 p.